Recent Trends in the Care of Patients With Non–ST-Segment Elevation Acute Coronary Syndromes

Insights From the CRUSADE Initiative

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Background: The extent to which national health quality improvement initiatives have altered reported treatment gaps among patients with non–ST-segment elevation acute coronary syndromes (NSTE ACS) is unknown. We sought to determine recent trends in adherence to guideline-based therapies for NSTE ACS.

Methods: We evaluated the treatment of patients with high-risk (positive cardiac markers and/or ischemic ST-segment changes) NSTE ACS enrolled in the Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes With Early Implementation of the ACC/AHA (American College of Cardiology/American Heart Association) Guidelines (CRUSADE) Quality Improvement Initiative from 2002 through 2004 (a total of 113 595 patients over 11 calendar quarters). We analyzed adherence to guideline-recommended therapies, including medications used in the acute care period (<24 hours after presentation), invasive procedures, in-hospital outcomes, and discharge therapies and interventions.

Results: The use of each class I guideline recommendation, as well as overall adherence to the guidelines, improved significantly ($P<.001$) during the study period. In the acute care setting, the use of antiplatelet agents increased by 5% and β-blockers by 12%; at hospital discharge, the use of antiplatelet agents increased by 3% and β-blockers by 8%. Heparin use in the acute care period increased by 6%, largely owing to a 9% increase in the use of low-molecular-weight heparin. Use of glycoprotein IIb/IIIa inhibitors in the acute care period also increased by more than 13%. At discharge, clopidogrel use increased by 22%, lipid-lowering agents by 11%, and angiotensin-converting enzyme inhibitors by 5%. While adherence improved, many patients still failed to receive 100% indicated treatments at the end of the study period.

Conclusions: During the 4 years since the initial release of the ACC/AHA guidelines for NSTE ACS, adherence to class I recommendations has significantly improved among hospitals participating in CRUSADE. Still, further improvements are needed for optimal implementation of the these guidelines.

Arch Intern Med. 2006;166:2027-2034

Management of patients with non–ST-segment elevation acute coronary syndromes (NSTE ACS) has undergone considerable evolution driven by empirical evidence from randomized clinical trials linking diagnostic tests and treatment strategies to improved outcomes. This definitive evidence has subsequently been promoted by the American College of Cardiology (ACC) and the American Heart Association (AHA). The expert panel of these professional societies formally published their consensus recommendations, initially in September 2000 and with subsequent revisions in October 2002, in the ACC/AHA guidelines for the management of patients with unstable angina and non–ST-segment elevation myocardial infarction (MI).[1] Prior studies have shown a long lag between the initial publication of new evidence creating national guidelines and their subsequent incorporation into routine medical practice.[2-4] Recognizing this, multiple organizations and groups have worked on improving the implementation of guidelines into practice.[5-8] The Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes With Early Implementation of the ACC/AHA Guidelines (CRUSADE) Quality Improve-

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ment Initiative represents one such effort at facilitating the rapid adoption of guidelines in to clinical practice.[9-12] However, the extent to which the treatment of patients with NSTE ACS has changed subsequent to the release of these guidelines and as a result of the diligent effort from multiple groups is currently not known.

The timing of the CRUSADE initiative provides an opportunity to study temporal changes in the treatment of patients with NSTE ACS at participating institutions following the publication of national guidelines.[9-12]

The purpose of this study was to examine the recent trends in the use of guideline-based therapies for patients with NSTE ACS. Our goal was to examine changes in adherence to both acute care and discharge class I guideline-recommended treatments and to document any persistent "gaps" with the ultimate goal of disseminating this information to stimulate change in systems to improve evidence-based care.

METHODS

PATIENTS, INCLUSION CRITERIA, DATA COLLECTION, AND GUIDELINE-BASED THERAPIES

The details of the CRUSADE Quality Improvement Initiative have been previously published.[9-12] In brief, patients admitted to 501 US hospitals participating in CRUSADE had ischemic symptoms at rest within 24 hours before presentation, as well as high-risk features, including ST-segment depression, transient ST-segment elevation, and/or positive cardiac markers (elevated troponin I or T and/or creatine kinase MB levels greater than the upper limit of normal for participating institutions).

The institutional review board of each hospital approved participation in CRUSADE. Because data were collected anonymously during hospitalization, informed consent was not required. Data collected included baseline use and timing of invasive cardiac procedures, laboratory results, in-hospital clinical outcomes, and discharge therapies and interventions. Decisions regarding the use of invasive procedures were made by the treating physicians. Contraindications to specific therapies given class IA or IB recommendations by the ACC/AHA guidelines were recorded.[1]

We evaluated adherence to individual guideline-based therapies for patients without any contraindications (**Table 1**). These therapies were based on class IA/IB guideline recommendations. In addition, a composite score of adherence to guidelines was generated by using methods previously described.[13] Composite adherence scores were calculated as a hospital's total number of times evidence-based care was given (based on quality indicators used in CRUSADE) divided by the total number of "care opportunities" for eligible patients (without contraindications) with high-risk NSTE ACS and were expressed as a percentage. In addition, patients were considered to have received 100% correct care if they received all indicated guideline-based treatments to which they had no contraindications.

We analyzed data from patients who were enrolled between January 2002 and September 2004 from sites that submitted data for more than 40 patients. The study sample thus comprised 11 quarters of data on 113 595 patients from 434 participating sites. Because each site joined enrollment during different periods during the study, the first quarter of data represent the data for the first quarter of enrollment for each site. A total of 151 sites (34.8%) had less than 2 years (<8 quarters) of follow-up, with the remaining sites having 2 or more years of follow-up.

TOOLS TO PROMOTE GUIDELINE-BASED THERAPIES AND DATA REPORTING TO SITES

At the time of their initial participation, sites were given the ability to access, customize, and use CRUSADE operational tools to promote adherence to evidence-based medicine in patients with NSTE ACS. These tools were targeted toward both patients and caregivers and included educational materials for caregivers, such as current national guidelines for managing patients with NSTE ACS and risk stratification tools that facilitated consistent categorization into low-, intermediate-, and high-risk subgroups; standardized orders for both admission and discharge; dosing algorithms; and tools to assist in the collection of performance indicator data. Participating hospitals were provided with quarterly feedback reports documenting their level of adherence to the ACC/AHA guidelines. Data were provided in a blinded fashion to maintain site confidentiality and included the sites' benchmark performance information compared with that of other enrolling sites. Each institution provided a performance report, with its ranking among "like" or similar national hospitals, as well as among "best practice hospitals"; specific areas that needed improvement were also identified. Hospitals were encouraged to continue to improve the existing care of patients with NSTE ACS at their institution by implementing CRUSADE tools and materials customized for their needs.

STATISTICAL ANALYSIS

Demographics, clinical characteristics, care patterns, invasive procedures, and in-hospital outcomes are presented for patients enrolled at baseline and in the last quarter. These characteristics were summarized as frequencies and percentages for categorical data and as medians and 25th and 75th percentiles for continuous variables. To test for independence of first and last quarters and clinical characteristics, in-hospital care patterns, and outcomes, Wilcoxon rank sum tests were used for continuous variables and χ^2 tests were used for categorical variables. Furthermore, to explore whether composite adherence scores increase over time, a random effects model with only time as the fixed effect was used. In such a model, the hospital was considered the random intercept and time as the random slope. This model allowed for adherence scores in each hospital to vary and accounts for the inherent correlation of responses (or scores). In addition, for individual medications, discharge interventions, and 100% of all guideline-recommended therapies, the Mantel-Haenszel χ^2 test controlling for the type of hospital was used to test for trend over time. Trends in adherence to both acute care (<24 hours) and discharge therapies were evaluated for patients with class IA or IB indications based on the recommendations of the ACC/AHA guidelines without any contraindications to such treatments as noted previously.[1] $P<.05$ was considered significant. All analyses were performed using SAS software version 8.2 (SAS Institute, Cary, NC).

RESULTS

CLINICAL CHARACTERISTICS AND IN-HOSPITAL EVENTS

The overall clinical characteristics of patients and the characteristics of patients enrolled in the first and last quarters are given in **Table 2**. Patients enrolled in CRUSADE had typical high-risk features that included older median age (68 years), positive cardiac markers (90%), prior coronary revascularization (33%), diabetes (33%), prior MI

Table 1. Performance Indicators*

Performance Indicators	Patient Eligible for Indicator	Contraindications
Acute care measures		
Aspirin	Those without contraindications	Active or recent bleeding, active ulcer or serious gastrointestinal or genitourinary bleeding, platelet count $<100 \times 10^9$ cells/L, do-not-resuscitate status, allergy/intolerance/hypersensitivity, clinical trial
Heparin	Those without contraindications	Active bleeding, bleeding history, hypersensitivity to pork products, platelet count $<100 \times 10^9$ cells/L, ulcer, history of heparin-induced thrombocytopenia, severe comorbid illness, do-not-resuscitate status, clinical trial
β-Blocker	Those without contraindications	Bradycardia, greater than first-degree atrioventricular block, cardiogenic shock, pulmonary edema, hypotension, chronic obstructive pulmonary disease/asthma/bronchospasm, allergy/intolerance/hypersensitivity
GP IIb/IIIa inhibitor	1. Those without contraindications 2. Those undergoing PCI <48 h, if a GP IIb/IIIa inhibitor was administered at least 1 h prior to PCI	Bleeding diathesis, bleeding within 30 d, severe hypertension, recent major surgery, recent stroke, any prior hemorrhagic stroke, platelet count $<100 \times 10^9$ cells/L, serum creatinine level >4.0 mg/dL (353.6 μmol/L)
Discharge measures		
Aspirin	Those without contraindications	Active or recent bleeding, active ulcer or serious gastrointestinal or genitourinary bleeding, platelet count $<100 \times 10^9$ cells/L, do-not-resuscitate status, allergy/intolerance/hypersensitivity, clinical trial
Clopidogrel	Those without contraindications	Active or recent bleeding, active gastroduodenal ulcer, serious gastrointestinal or genitourinary bleeding, platelet count $<100 \times 10^9$ cells/L, allergy/intolerance/hypersensitivity
β-Blocker	Those without contraindications	Bradycardia, greater than first-degree atrioventricular block, cardiogenic shock, pulmonary edema, hypotension, chronic obstructive pulmonary disease/asthma/bronchospasm, allergy/intolerance/hypersensitivity
ACE inhibitor	Those with hypertension, diabetes, CHF, or LVEF <40%	Allergy/intolerance/hypersensitivity, pregnancy, hypotension, angioedema, renal dysfunction, hyperkalemia, severe comorbid illness, do-not-resuscitate status, clinical trials
Lipid-lowering agent	History of hyperlipidemia or LDL-C level >100 mg/dL (>2.59 mmol/L)	Allergy/intolerance/hypersensitivity, abnormal liver function test results, active myositis/muscular disorder, severe comorbid illness, do-not-resuscitate status, clinical trial
Smoking cessation counseling	If a current smoker	Contraindication checked as yes on the case report form
Dietary modification counseling	All	Contraindication checked as yes on the case report form
Cardiac rehabilitation referral	All patients with positive cardiac markers indicating NSTE MI	Contraindication checked as yes on the case report form

Abbreviations: ACE, angiotensin-converting enzyme; CHF, congestive heart failure; GP, glycoprotein; LDL-C, low-density lipoprotein cholesterol; LVEF, left ventricular ejection fraction; PCI, percutaneous coronary intervention; NSTE MI, non–ST-segment elevation myocardial infarction.
*Patients who died were ineligible for discharge indicators.

(30%), prior congestive heart failure (18%), renal insufficiency (13%), and prior stroke (11%). Only 56% of patients were admitted to an inpatient cardiology service, whereas the rest were admitted to generalists' care. The absolute differences between the clinical features in the first vs last quarters of patient enrollment were lower than 5% for most variables with the exception of ST-segment depression and positive cardiac enzymes, which were 7% higher and 6% lower, respectively, in patients in the first quarter compared with those in the last quarter. Unadjusted in-hospital clinical events showed a reduction in mortality rates and other adverse outcomes (except for cardiogenic shock) at the end of the study period (**Table 3**).

TRENDS IN THE USE OF GUIDELINE-BASED THERAPIES

Trends in the adherence to class IA/IB guideline recommendations among patients in whom there were no contraindications are given in **Table 4** and **Figures 1**, **2**, **3**, and **4**. As shown, the number of patients enrolled in CRUSADE in the first and last quarter was not significantly different. In addition, the proportion of patients who were eligible for each indicator was similar for most quality indicators. Adherence to all such treatments improved over time (*P* for trend, <.001 for all performance measures). The use of antiplatelet agents increased by 5% in the acute care period (<24 hours) and by 3% at discharge, and the use of β-blockers increased by 12% in the acute care period and by 8% at discharge. Heparin use in the acute care period increased by 6%, largely owing to a 9% increase in the use of low-molecular-weight heparin, and there was a small decline (2%) in the use of unfractionated heparin. The use of glycoprotein IIb/IIIa inhibitors increased by 14% during the study. In indicated patients, the use of clopidogrel, lipid-lowering agents, and angiotensin-converting enzyme inhibitors at discharge increased by 21%, 11%, and 5%, respectively. Similar encouraging trends for improvement were observed for dietary and lifestyle modification (counseling for smoking cessation and referral for cardiac rehabilitation), with an absolute increase varying from 17% to 28%. Furthermore,

Table 2. Clinical and Hospital Characteristics*

Characteristic	First Quarter (n = 11 154)	Last Quarter (n = 11 111)	Overall (n = 113 595)
Age, y	68 (56-78)	67 (56-78)	68 (56-78)
Sex: female	40.6	38.9	39.9
BMI	27.5 (24.3-31.8)	27.8 (24.4-32.0)	27.7 (24.3-31.9)
Race: white	79.6	79.5	80.4
Family history of CAD	36.3	36.7	35.9
Hypertension	68.2	69.6	69.0
Diabetes mellitus	32.6	32.2	32.8
Current/recent smoker	27.8	27.7	27.2
Hypercholesterolemia	46.3	50.5	47.7
Prior MI	30.6	28.7	30.0
Prior PCI	21.4	21.1	21.1
Prior CABG	20.2	19.9	19.8
Prior CHF	18.9	16.9	17.8
Prior stroke	10.9	9.2	10.5
Renal insufficiency†	13.3	12.8	13.4
Presenting characteristics			
Heart rate, beats/min	82 (70-98)	82 (70-97)	82 (70-98)
Systolic BP, mm Hg	144 (124-165)	143 (124-165)	144 (124-165)
ST depression	41.2	33.9	36.5
Transient ST elevation	8.6	6.6	7.6
Positive cardiac markers	85.4	91.5	89.6
CHF at presentation	22.9	22.8	22.7
Hospital characteristics			
CABG facility	75.6	75.2	74.5
Hospital beds	380 (249-508)	367 (238-518)	367 (242-500)
Academic teaching hospital‡	29.4	25.3	27.2
Cardiology care§	56.1	57.4	56.3

Abbreviations: BP, blood pressure; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); CABG, coronary artery bypass grafting; CAD, coronary artery disease; CHF, congestive heart failure; HMO, health maintenance organization; MI, myocardial infarction; PCI, percutaneous coronary intervention.

*Data are given as percentage of patients or median (25th-75th percentiles) value.

†Defined as creatinine level higher than 2.0 mg/dL (176.8 µmol/L), calculated creatinine clearance lower than 30 mL/min (0.5 mL/s), or need for chronic renal dialysis.

‡Based on membership in the Council of Teaching Hospitals.

§Admitted to a primary cardiology service.

Table 3. In-Hospital Events*

Event	First Quarter (n = 11 154)	Last Quarter (n = 11 111)	Overall (n = 113 595)
Mortality	5.1	4.2	4.7
Postadmission MI	3.8	2.6	2.9
Death or MI	8.2	6.4	7.0
Cardiogenic shock	2.7	2.7	2.7
Congestive heart failure	10.9	7.5	8.6
Any RBC transfusion	15.0	13.8	14.7

Abbreviations: MI, myocardial infarction; RBC, red blood cell.

*Data are given as percentage of patients. All P values are $<.01$ except for cardiogenic shock ($P = .77$).

the use of cardiac catheterization increased during the study period. Overall revascularization increased by approximately 8%, largely because of incremental use of percutaneous coronary interventions (8% absolute increase). In contrast, there was a slight decline in the rates of coronary artery bypass surgery (2%). The rates of adherence to various therapies for NSTE ACS for the last quarter in the most motivated (top 10% performing) institutions are given in Table 4. An absolute increase of 9%, from 72% to 81%, was observed in the composite scores for acute care medications from the first to last quarter of the study period. Similarly, the composite scores for discharge medication increased by 10% from 72% in the first quarter to 82% in the last quarter (Figure 3). The proportion of patients who received all guideline-recommended therapies with no contraindications (ie, those who had 100% compliance with guidelines) increased from 30% to 48% for acute care medications, 30% to 50% for discharge medications, and 16% to 33% for overall medications during the study period (Figure 4).

COMMENT

Our study revealed significant trends toward improvements in adherence to ACC/AHA guideline-based class IA/IB therapies among a wide variety of institutions participating in the CRUSADE initiative in recent years. Importantly, an increase in adherence to the ACC/AHA guidelines was observed with regard to all acute care and discharge therapies. This suggests that changes in treatment processes by different sites were effective in the adoption of guideline recommendations, even though time

Table 4. Acute (<24 h) and Discharge Care Patterns and Invasive Procedures*

Variable	First Quarter Eligible, % of Overall Patients (n = 11 154)	First Quarter Treated, % of Eligible Patients	Last Quarter Eligible, % of Overall Patients (n = 11 111)	Last Quarter† Treated, % of Eligible Patients	Top 10%‡ Treated, % of Eligible Patients (n = 1117)
Acute care					
Oral antiplatelet, any	94.6	92.0	96.8	96.1	99.4
Aspirin	93.0	89.6	94.9	95.3	98.4
Clopidogrel	98.1	36.1	90.2	51.5	72.4
β-Blocker	91.4	76.4	89.7	86.8	95.9
Heparin, any	93.9	81.7	93.2	87.4	95.7
Unfractionated heparin	93.9	51.0	93.2	48.6	54.0
LMWH	93.9	36.8	93.2	45.8	48.7
GP IIb/IIIa inhibitor	87.2	33.2	83.4	44.6	71.2
Discharge care					
Antiplatelet agents, any	76.5	92.8	79.4	95.3	99.5
Aspirin	74.8	88.9	77.4	93.2	98.0
Clopidogrel	79.1	50.4	75.5	68.7	85.6
β-Blocker	73.9	81.2	76.6	88.6	96.5
Lipid-lowering agents§	49.2	77.7	54.9	86.8	93.4
ACE inhibitor‖	59.6	58.9	59.5	63.7	80.6
Diet modification counseling	83.2	66.5	83.6	81.5	96.6
Smoking cessation counseling	23.6	58.6	23.4	83.1	92.5
Cardiac rehabilitation referral	70.2	36.9	69.8	60.3	88.7
Invasive procedures in-hospital					
Cardiac catheterization		60.4		67.3	77.4
Cardiac catheterization <24 h		26.7		34.6	48.9
Cardiac catheterization <48 h		40.0		50.1	64.6
PCI		35.4		42.0	53.6
PCI <24 h		17.1		23.6	33.6
PCI <48 h		24.6		32.2	44.4
CABG		11.3		10.0	9.3

Abbreviations: ACE, angiotensin-converting enzyme; CABG, coronary artery bypass grafting; GP, glycoprotein; LMWH, low-molecular-weight heparin; PCI, percutaneous coronary intervention.

*Medication use only included patients without contraindications (eligible).

†All *P* values are <.01.

‡During the last quarter.

§For patients with a history of hypercholesterolemia or measured low-density lipoprotein cholesterol level higher the 100 mg/dL (>2.59 mmol/L) without contraindications.

‖For patients with an ejection fraction lower than 40%, congestive heart failure, diabetes mellitus, or hypertension without contraindications.

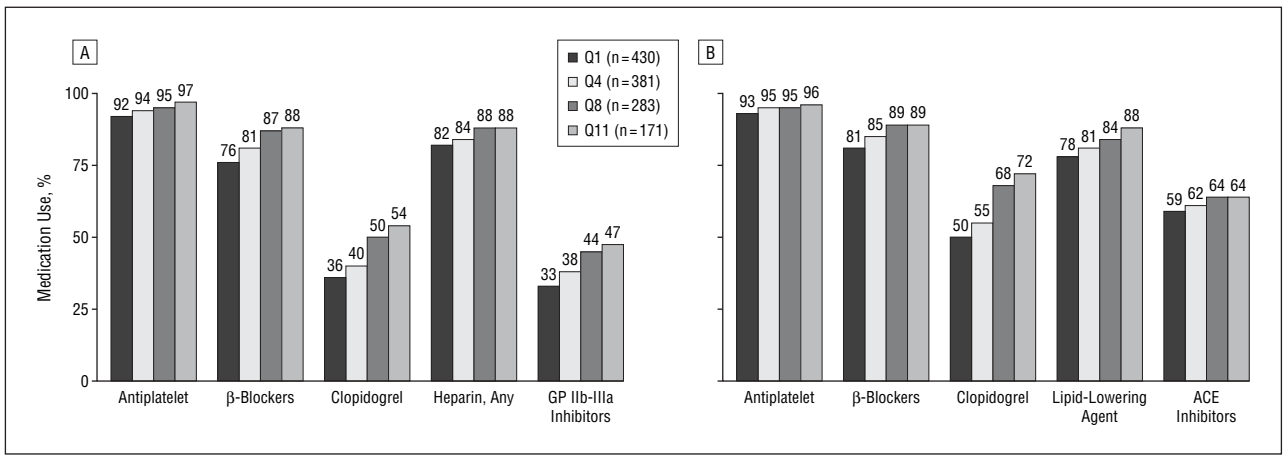

Figure 1. Trends in individual acute care (<24 hours) (A) and discharge (B) medication use during the study period (*P* for trend for all, <.001). Q1, Q4, Q8, and Q11 represent data from quarters 1, 4, 8, and 11 for all enrolling sites; n, number of sites enrolling patients. ACE indicates angiotensin-converting enzyme.

frames for meeting acute care treatment measures were short (<24 hours). The use of relatively newer therapies such as clopidogrel, low-molecular-weight heparin, and glycoprotein IIb/IIIa inhibitors increased over time. There was a significant increase in the proportion of patients who received all indicated guideline-recommended acute care and discharge therapies (those in whom compliance with evidence-based medicine was 100%). Perhaps even more heartening was the incremental compliance with dietary and lifestyle modification goals, which typically have been

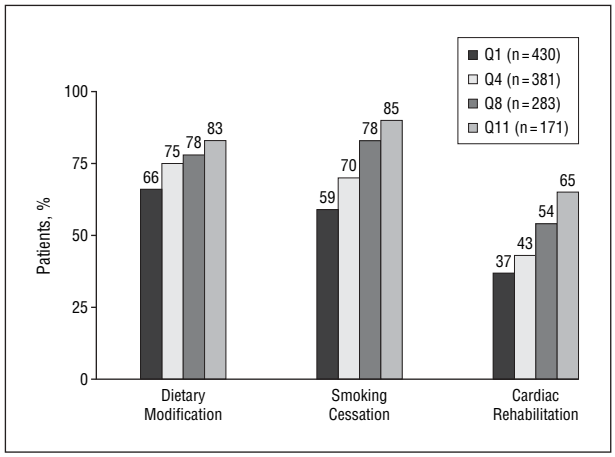

Figure 2. Trends in discharge diet and lifestyle modification during the study period (*P* for trend for all, <.001). Q1, Q4, Q8, and Q11 represent data from quarters 1, 4, 8, and 11 for all enrolling sites; n, number of sites enrolling patients.

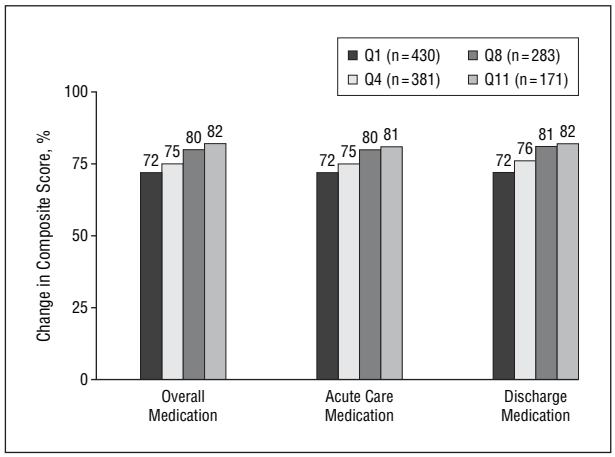

Figure 3. Change in the overall, acute care, and discharge medication composite scores during the study period (*P* from mixed model for all, <.001). Q1, Q4, Q8, and Q11 represent quarter 1, 4, 8, and 11 data for all enrolling sites; n, number of sites enrolling patients.

neglected more than pharmacological therapies. Furthermore, in keeping with data regarding the benefits of an aggressive invasive approach,[14-16] more patients underwent cardiac catheterization over time. This resulted in an increase in the revascularization rate over time. Thus, our results show that the care of patients with NSTE ACS is significantly improving among institutions that set goals for improving compliance with guideline-based therapies. In fact, the most motivated institutions (top 10%) had remarkably higher rates of adherence to acute care and discharge treatment goals that were in excess of 90% for most indicators and almost 100% for antiplatelet agents used in the acute care period (Table 4).

COMPARISON WITH PRIOR STUDIES

Whereas many prior studies have shown progress in the care of patients with acute MI[2-4,7,8,17] and congestive heart failure,[18-20] few studies have evaluated trends in treatments among the much larger population of patients with NSTE ACS since the release of the ACC/AHA guide-

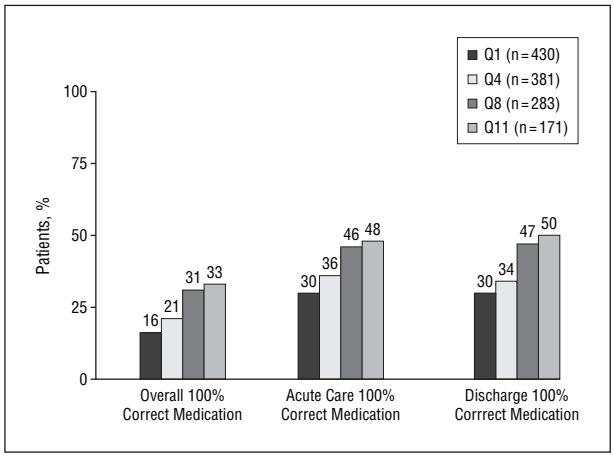

Figure 4. Trends in the proportion of patients who received 100% of all guideline-recommended therapies for which there were no contraindications for overall, acute care, and discharge medications during the study period (*P* for trend for all, <.001). Q1, Q4, Q8, and Q11 represent quarter 1, 4, 8, and 11 data for all enrolling sites; n, number of sites enrolling patients.

lines. In the 1990s, observational studies such as the Thrombolysis in Myocardial Ischemia (TIMI) III and Global Unstable Angina Registry and Treatment Evaluation (GUARANTEE) registries showed temporal improvements in the use of aspirin, heparin, and β-blockers for patients with NSTE ACS.[21-23] Nonetheless, these studies indicated underutilization of specific therapies and confirmed that physician preferences and treatment biases had an adverse effect on compliance with evidence-based treatments. The Cardiac Hospitalization Atherosclerosis Management Program (CHAMP) has suggested mechanisms of improving guideline-based therapies at a single center.[6] However, the CHAMP study preceded the publication of national guidelines for the management of patients with NSTE ACS. One recent pilot project, Get With the Guidelines, showed improvement in the care of patients with NSTE ACS.[4] Our data are consistent with these reports and suggest that efforts by multiple organizations can overcome barriers that limit implementation of evidence-based care. Investigators of the Global Registry of Acute Coronary Events, a contemporary registry that collected data after release of national guidelines for NSTE ACS, have shown similar trends in improvement in adherence to guideline-based treatments.[24]

There are important differences between our study and those previously mentioned. Most prior studies were either carried out in small groups of patients with NSTE ACS or were restricted to specific local areas or, as in the Global Registry of Acute Coronary Events (GRACE), included only a few North American sites.[4,6-8,24] Most predated the publication of the ACC/AHA guidelines for the management of patients with NSTE ACS. In some studies, the focus was on discharge therapies[4,6] and acute care was not evaluated. Others reported care of all patients with ACS (NSTE and ST-segment elevation ACS) together.[24] Few other programs provided interval feedback that rated local care against regional and national or international benchmarks, and interventions to improve guideline adherence were not specifically promoted.[5,24,25] In contrast, the CRUSADE initiative is an evolution from this prior single center or local attempt directed at a small number of pa-

tients to an effort directed to include a much larger, more diverse group of patients seen in community practice throughout North America. Furthermore, it provides sites with quarterly feedback of their performance measures along with access to tools that could be customized for each institution to meet evidence-based treatment goals.

OPPORTUNITIES FOR FURTHER QUALITY IMPROVEMENT

Whereas many institutions participating in CRUSADE have shown remarkable advances in patient care, there is certainly potential for further improvement. Considerable variation in performance measures was observed among sites. By the end of the study period, use of many recommended therapies was still lower than 90% (β-blockers, heparin, and glycoprotein IIb/IIIa inhibitors in the acute care period and β-blockers, clopidogrel, angiotensin-converting enzyme inhibitors, and lipid-lowering agents at discharge). Two thirds of patients failed to receive 1 or more therapies indicated for their condition as recommended by the national guidelines.

Participating hospitals that did not meet performance goals or showed only marginal improvement on baseline care had the opportunity to learn from the top 10% performing CRUSADE sites. These top 10% were able to achieve rates of adherence to various evidence-based therapies that could be exemplary for institutions that continue to show significant "gaps" in the care of their patients. Furthermore, the "gaps" were more evident for some treatments compared with others. For example, less than half of the patients received a glycoprotein IIb/IIIa inhibitor despite the fact that most patients had elevated troponin levels, and these are the patients most likely to benefit from the therapy.[1] Clopidogrel and angiotensin-converting enzyme inhibitors were not prescribed to one third of patients at discharge. Despite having the greatest relative increase in adherence during the course of the study, dietary and lifestyle modifications had the greatest potential for additional improvement. Thus, efforts need to focus on establishing a culture that would encourage utilization rates of all performance measures among a wide variety of institutions across the nation. We propose that if hospitals and caregivers strive to provide the "best" care to their patients, they will embrace a new concept of "100% correct care" as a marker of quality rather than focusing on improving only individual therapies.

Finally, we observed a trend for lower mortality that paralleled the improvement in performance measures. This association between better quality of care and improved outcomes is similar to that reported previously by investigators from another quality improvement initiative.[24] Although it is tempting to associate the improved outcomes with better care, caution needs to be exerted in attributing causality because of the observational nature of our analysis.

STRENGTHS AND LIMITATIONS

To our knowledge, our study is the first to show that there is significant improvement in the treatment of patients with NSTE ACS not only within institutions or regions but on a national scale, particularly in the era of technological advances such as the Internet that allows immediate sharing of knowledge and experience. Unlike patients with acute MI, those admitted with NSTE ACS represent a more heterogeneous and larger group for whom the quality indicators have not been clearly delineated. In addition, risk stratification, which begins in the emergency department, is linked to therapy selection, often multifaceted strategies requiring both emergency department and in-patient care. The CRUSADE initiative has been able to meet these challenges. The CRUSADE initiative is the first program to unite emergency department physicians, generalists, and cardiologists at a national level to improve the care of patients with NSTE ACS. The ideal time required to assess the effects of any intervention remains unclear. The CRUSADE initiative mitigates this uncertainty by providing information about continuous trends in practice in real time, thus supporting the fact that the effort is gaining momentum, as evidenced by improving practice. The magnitude of the changes is sufficiently reassuring that meaningful improvements are being achieved, rather than small changes made significant by large sample sizes.

Our study has inherent limitations. Like most prior studies that have shown improving trends in the treatment of patients with acute MI or congestive heart failure, no control group was included, thus raising the possibility that the observed improvement was due to a natural progression toward higher guideline compliance with exposure to the program initiatives over time. All participating institutions volunteered to join the CRUSADE initiative; therefore, these findings may not be applicable to institutions that have shown no incentive to track and improve their trends in care. Information about lifestyle modification interventions (smoking cessation, referral for cardiac rehabilitation, and diet modification counseling) were determined from notations in the medical record that these interventions were provided to the patient prior to discharge. However, we could not ascertain the strength of emphasis of each intervention (such as a quick reminder to quit smoking vs in-depth smoking cessation counseling and education). This phenomenon likely affects all quality improvement studies, as well as ongoing Joint Commission on Accreditation of Healthcare Organization (JCAHO) acute MI core measures data collection. The focus in CRUSADE was on in-patient care, and caution needs to be exercised when applying these results to an ambulatory setting. The use of quality improvement tools as well as the magnitude of the effects of individual tools used by various sites could not be assessed because these data were not comprehensively collected. Finally, we cannot provide information on the cost-effectiveness of such a large-scale quality improvement initiative.

CONCLUSIONS

The CRUSADE data suggest that the implementation of class I guidelines recommendations for NSTE ACS care has improved significantly among hospitals participating in CRUSADE. The guidelines still need to be implemented on a broader scale if we are to achieve better health

care for all patients. We hope these promising results will motivate more hospitals to participate in programs or develop internal systems designed to achieve compliance with the ACC/AHA guidelines. Thus, the CRUSADE initiative provides a foundation for future projects targeting improvement in evidence-based care for various disease processes at the national level.

Accepted for Publication: June 13, 2006.
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Financial Disclosure: None reported.
Funding/Support: The CRUSADE initiative is a National Quality Improvement Initiative of the Duke Clinical Research Institute and is funded by the Schering-Plough Corporation. Bristol-Myers Squibb/Sanofi-Aventis Pharmaceuticals Partnership provides additional funding support. Millennium Pharmaceuticals, Inc, also funded this work.
Acknowledgment: We thank David Z. Bynum, MEM, for his editorial assistance.

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